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Kim et al.

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(54) **SCROLL COMPRESSOR**

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(51) **Int. Cl.**

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F04C 28/26	(2006.01)
F16K 17/04	(2006.01)
F04C 23/00	(2006.01)
F04C 28/16	(2006.01)
F04C 29/12	(2006.01)

(52) **U.S. Cl.**

CPC ***F04C 18/0215*** (2013.01); ***F04C 18/0261*** (2013.01); ***F04C 23/008*** (2013.01); ***F04C 28/16*** (2013.01); ***F04C 28/26*** (2013.01); ***F04C 29/124*** (2013.01); ***F16K 17/04*** (2013.01)

(58) **Field of Classification Search**

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USPC 418/55.1, 55.2, 75, 183, 186, 55.5, 57; 417/310, 308
See application file for complete search history.

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(57) **ABSTRACT**

A scroll compressor is provided. The scroll compressor may include a valve and a valve spring accommodated in a housing as one module, and the housing may be directly coupled to a fixed scroll. This may simplify assembly processes of the scroll compressor. Further, a sealing recess that communicates with a middle pressure chamber may be formed at the housing, thereby forming a damping space between a high pressure space and a low pressure space. This may prevent lowering of performance of the scroll compressor due to leakage of refrigerant inside the high pressure space to the low pressure space in a normal driving mode.

22 Claims, 10 Drawing Sheets

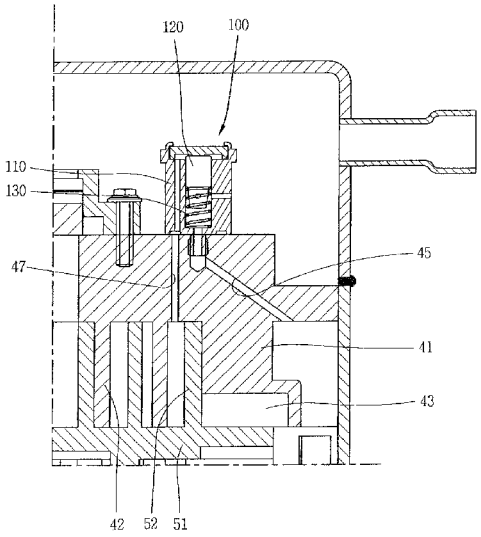

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FIG. 1

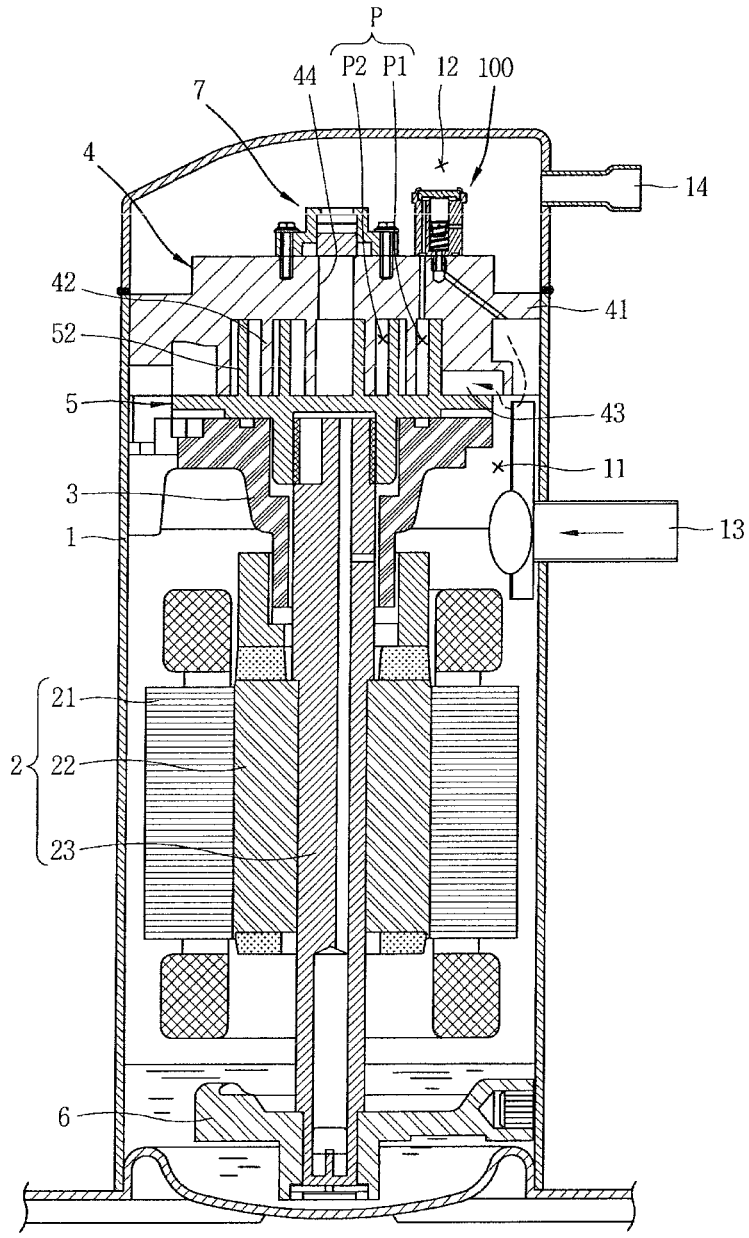

FIG. 2

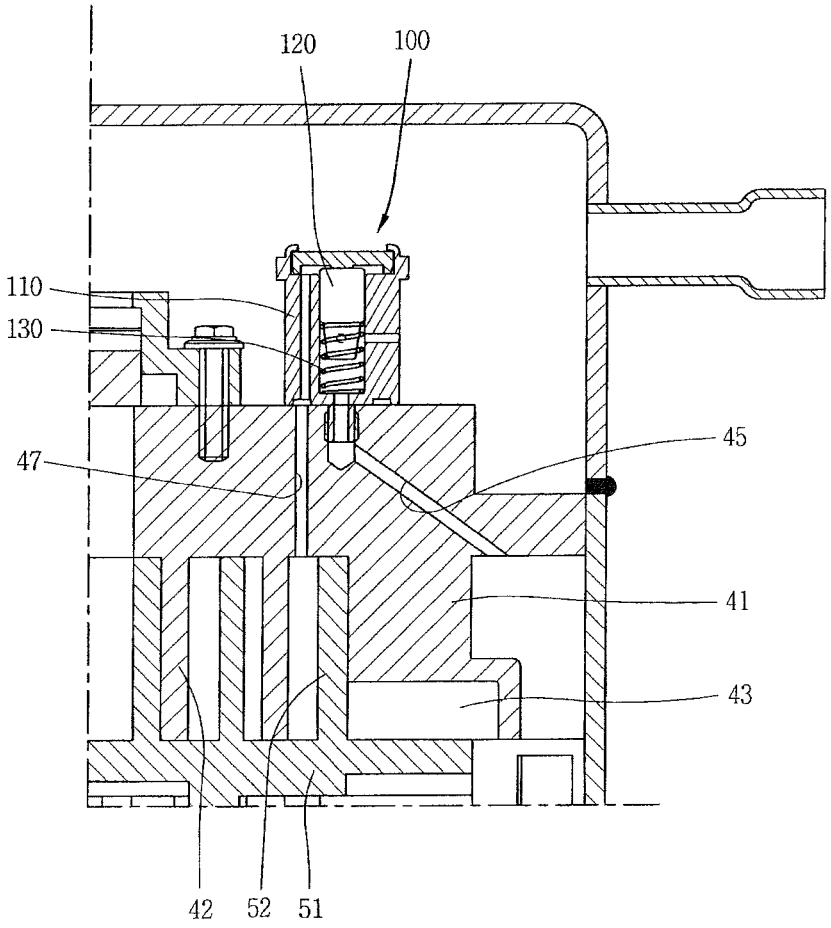

FIG. 3

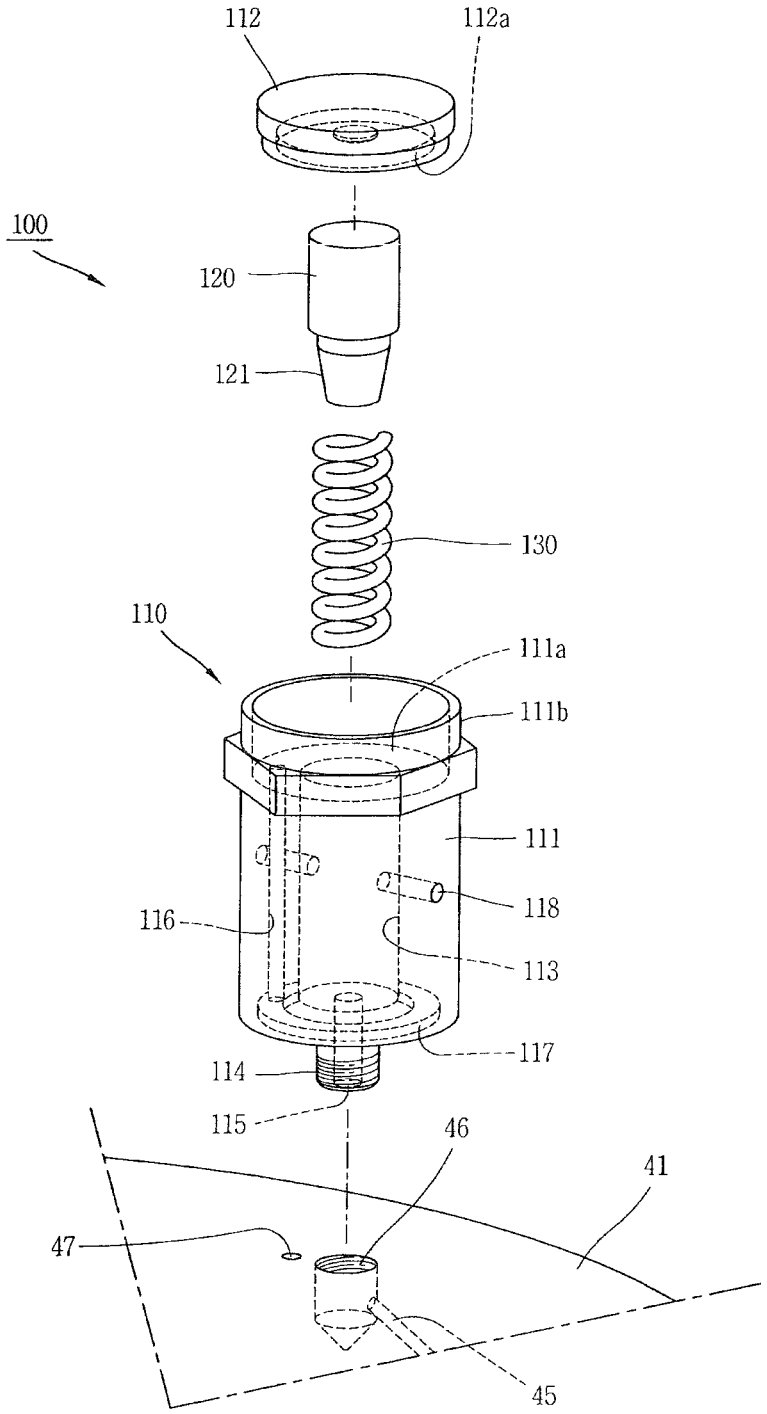
112
112a
100
120
121
130
110
111a
111b
111
116
118
113
117
114
115
46
41
47
45

FIG. 4

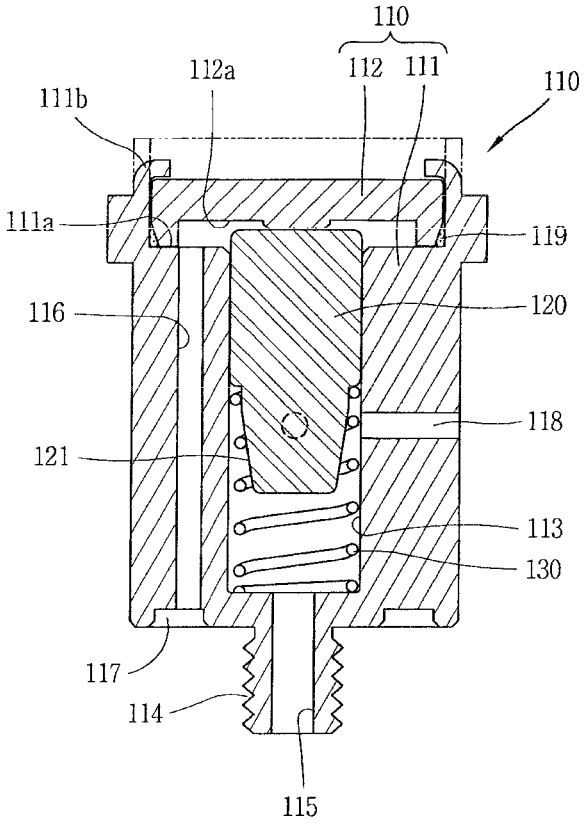
110
112a
112
111
110
111b
111a
119
116
120
118
121
113
130
117
114
115

FIG. 5

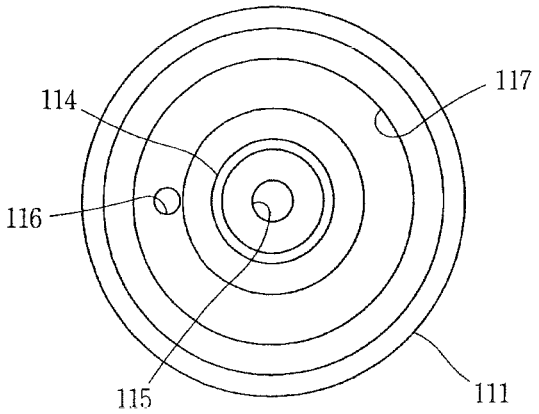
114
117
116
115
111

FIG. 6

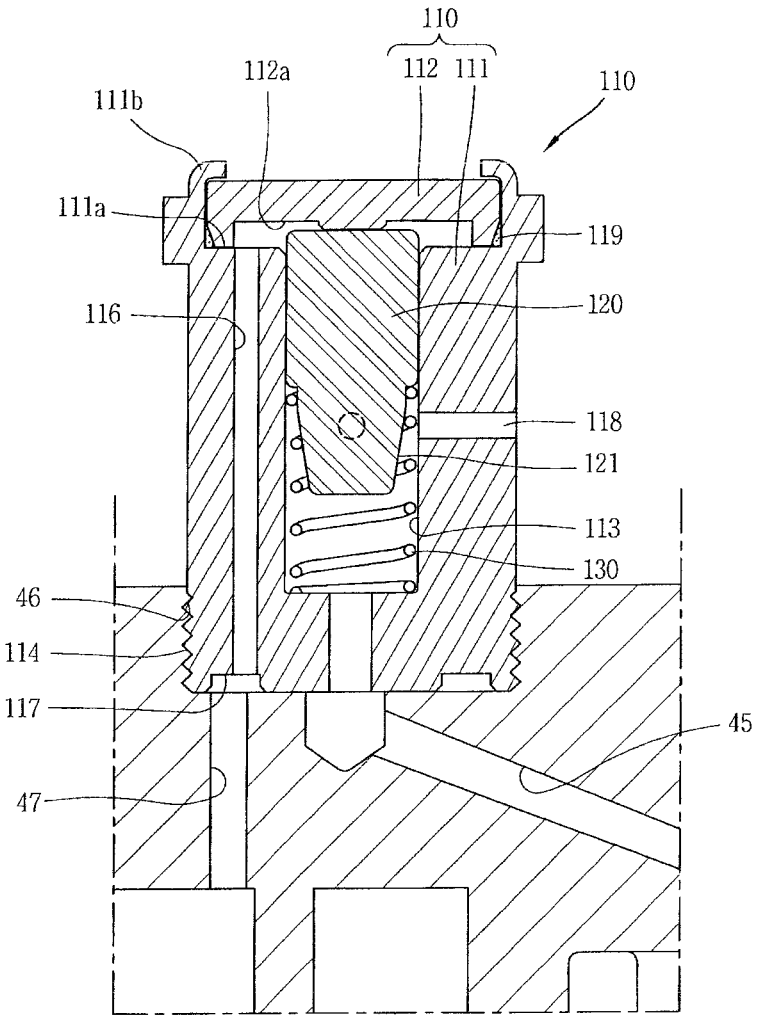
110
112a
112
111
110
111b
111a
119
116
120
118
121
113
130
46
114
117
45
47

FIG. 7

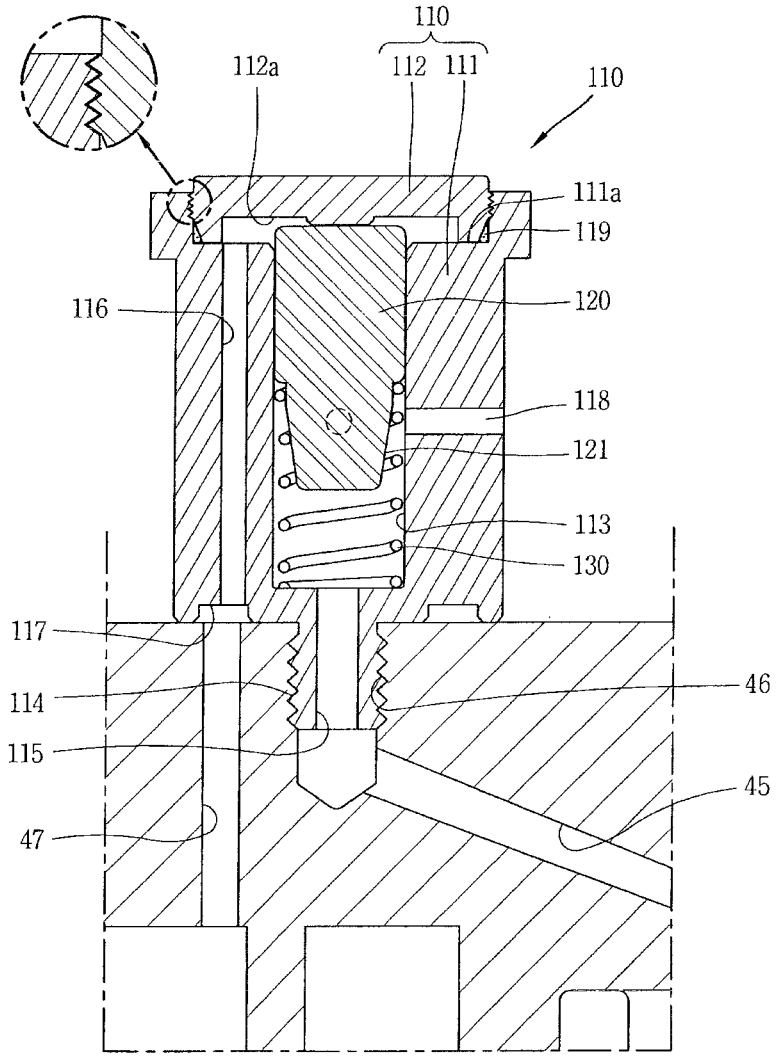
110
112a
112
111
110
111a
119
116
120
118
121
113
130
117
46
114
115
45
47

FIG. 8

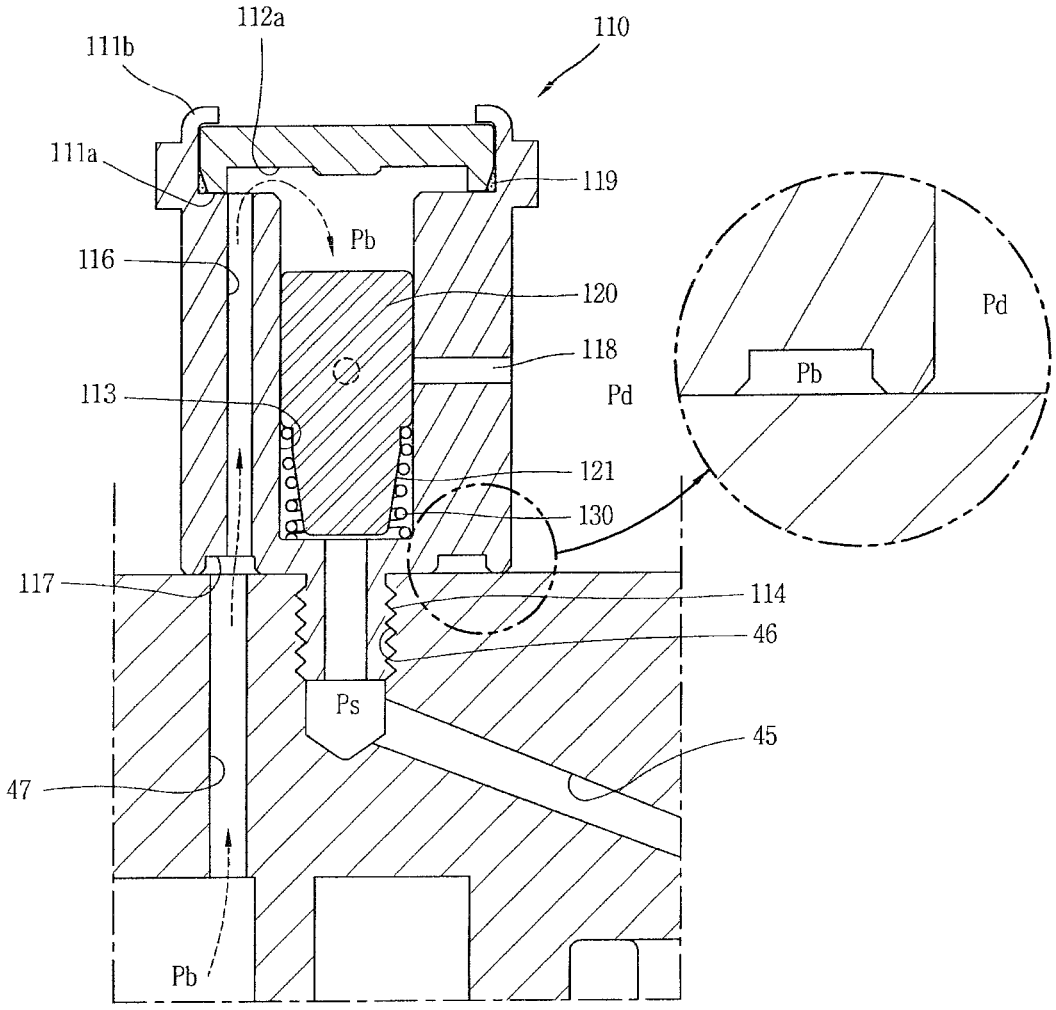
112a
110
111b
111a
119
Pb
116
120
118
Pd
113
121
130
117
114
46
Ps
45
47
Pb
Pd
Pb

FIG. 9

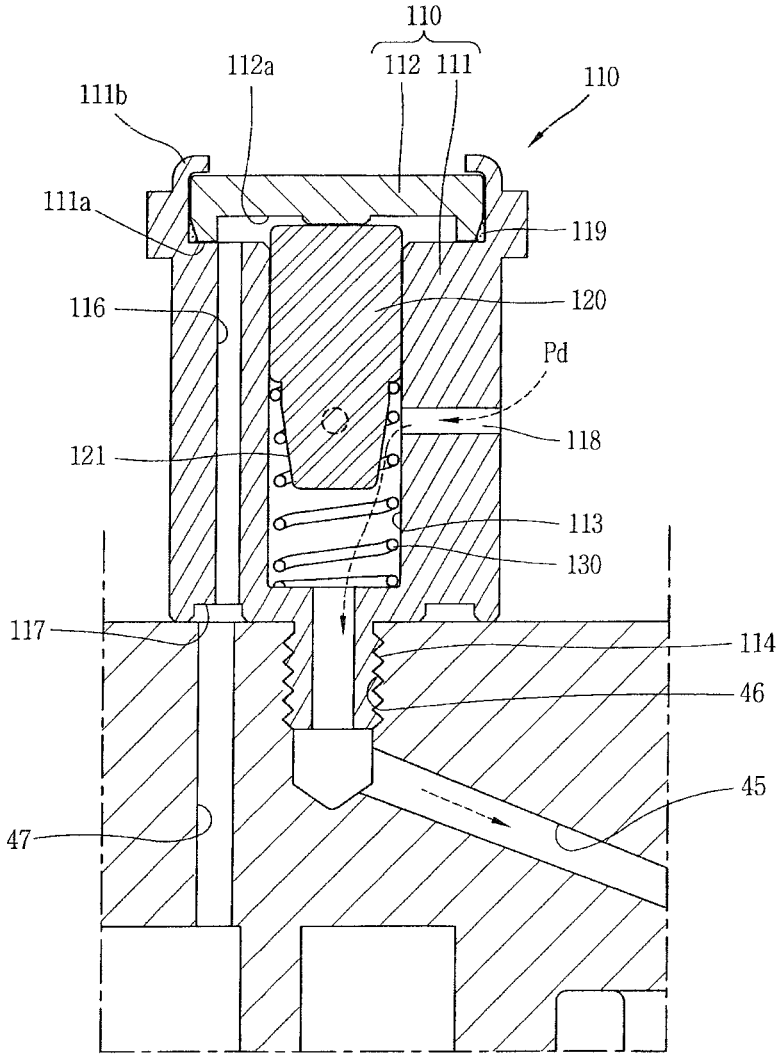
110
112a
112 111
110
111b
111a
119
116
120
Pd
118
121
113
130
117
114
46
45
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FIG. 10

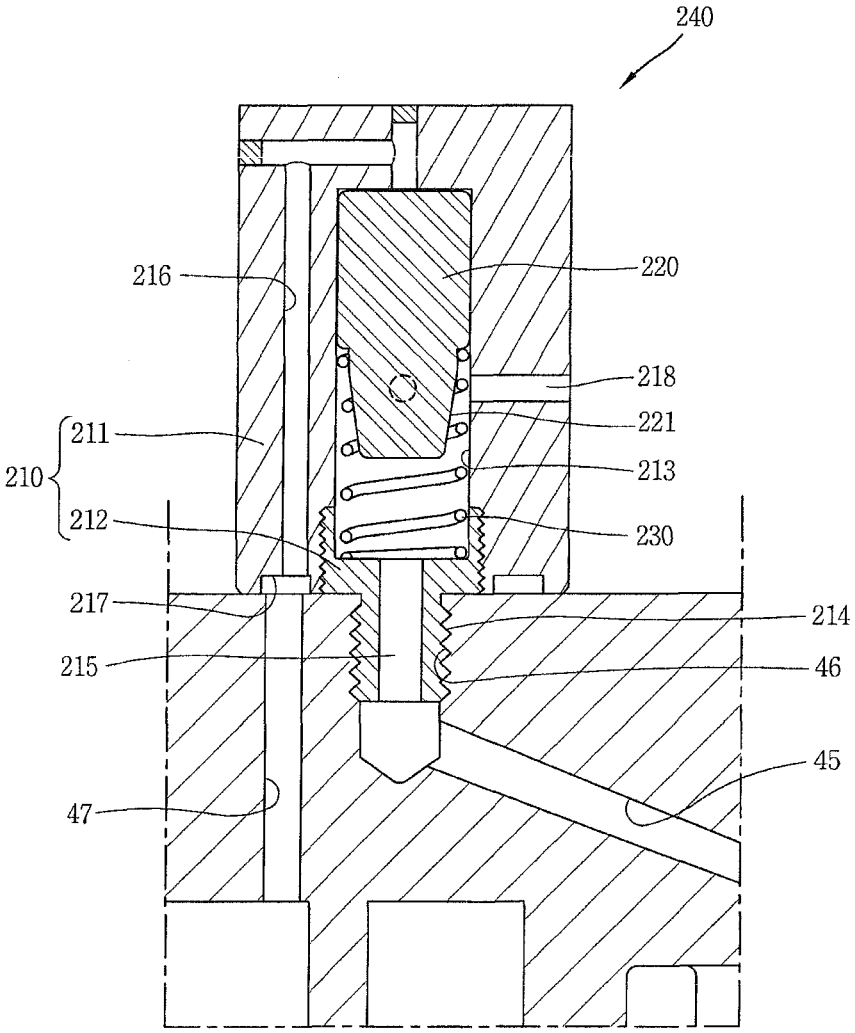
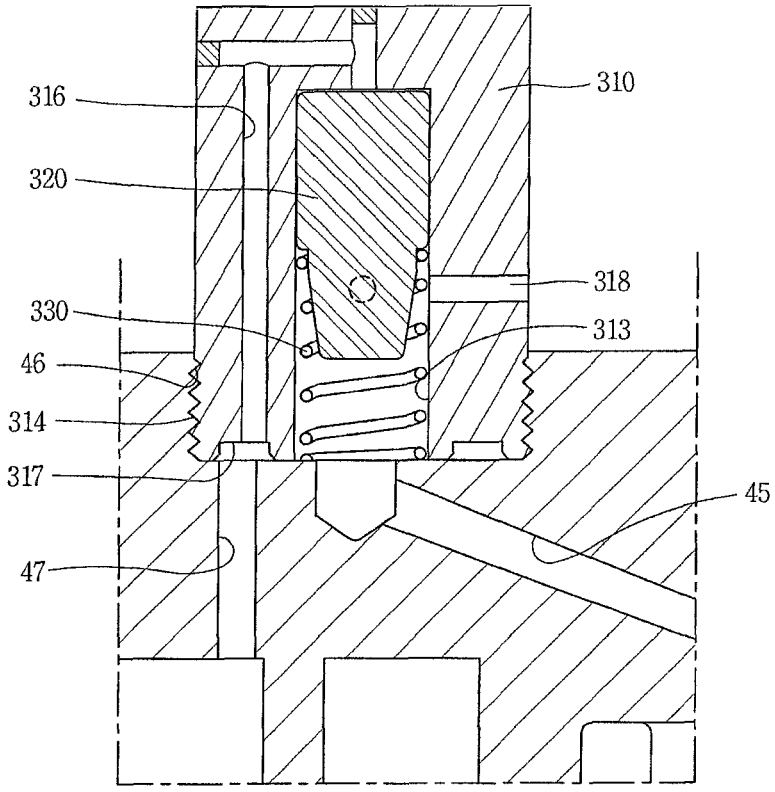


FIG. 11



SCROLL COMPRESSOR

CROSS-REFERENCE TO RELATED APPLICATION(S)

Pursuant to 35 U.S.C. §119(a), this application claims priority to Korean Application No. 10-2010-0067100, filed in Korea on Jul. 12, 2010, the content of which is incorporated by reference herein in its entirety.

BACKGROUND

1. Field

A scroll compressor is disclosed herein.

2. Background

Scroll compressors are known. However, they suffer from various disadvantages.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:

FIG. **1** is a longitudinal section view of a low pressure type scroll compressor according to an embodiment;

FIG. **2** is a longitudinal section view showing a state in which a vacuumization prevention device is installed at an outer side of a fixed scroll according to an embodiment;

FIG. **3** is a disassembled perspective view of the vacuumization prevention device of FIG. **2**;

FIG. **4** is a longitudinal section view showing an assembled state of the vacuumization prevention device of FIG. **3**;

FIG. **5** is a bottom planar view of the vacuumization prevention device of FIG. **2**;

FIG. **6** is a longitudinal section view of a fixing portion of the vacuumization prevention device of FIG. **4**;

FIG. **7** is a longitudinal section view showing a coupling method of a housing cover of the vacuumization prevention device of FIG. **4**;

FIG. **8** is a longitudinal section view showing an operation of the vacuumization prevention device when the scroll compressor operates in a normal driving mode;

FIG. **9** is a longitudinal section view showing an operation of the vacuumization prevention device when the scroll compressor operates in a high-vacuum driving mode;

FIG. **10** is a longitudinal section view showing a vacuumization prevention device of a scroll compressor according to another embodiment; and

FIG. **11** is a longitudinal section view showing a vacuumization prevention device of a scroll compressor according to still another embodiment.

DETAILED DESCRIPTION

Description of embodiments will now be given in detail with reference to the accompanying drawings. Where possible, like reference numerals have been used to indicate like elements, and repetitive description has been omitted.

A scroll compressor is a compression apparatus that forms a pair of compression chambers, which consecutively move between a fixed wrap and an orbiting wrap when an orbiting scroll performs an orbiting motion, in a state in which a fixed scroll is fixed to an inner space of a hermetic container, and the orbiting wrap of the orbiting scroll is interlocked with the fixed wrap of the fixed scroll.

This scroll compressor may have a higher compression ratio than other types of compressors. Further, the scroll compressor may obtain a stable torque because a suction process, a compression process, and a discharge process for refrigerant may be smoothly performed. Due to these advantages, scroll compressors are widely applied to air conditioning systems as a refrigerant compression apparatus.

In the scroll compressor, a volume of the compression chamber may be gradually decreased when the orbiting scroll performs an orbiting motion, thereby compressing refrigerant filled in the compression chamber. Once the refrigerant is compressed to a predetermined compression ratio, the refrigerant is discharged out through a discharge opening. The scroll compressor may be categorized as a low pressure type or indirect suction type, and a high pressure or direct suction type according to a refrigerant suction method.

In the case of the low pressure scroll compressor, a suction space, which is a low pressure space, and a discharge space, which is a high pressure space, have to be separated from each other at a time of normal driving. On the other hand, when the low pressure scroll compressor has a very low suction pressure, such as during a pump down driving mode or a cycle blocking driving mode, the suction space and the discharge space communicate with each other. In this state, a high pressure refrigerant discharged to the discharge space backflows into the suction space. Accordingly, the refrigerant which backflows into the suction space is supplied to the compression chamber, thereby preventing a high-vacuum driving of the scroll compressor.

In the case of the high pressure scroll compressor, a suction opening which is a low pressure space, and an inner space of a hermetic container, which is a high pressure space, have to be separated from each other at a time of a normal driving mode. On the other hand, at a time of a pump down driving mode or a cycle blocking driving mode, the suction opening and the inner space of the hermetic container communicate with each other. In this state, a refrigerant discharged to the inner space of the hermetic container is partially re-introduced to the suction opening. This may prevent a high-vacuum driving of the scroll compressor.

In order to selectively shield the low pressure space and the high pressure space of the scroll compressor according to a driving condition of the scroll compressor, a valve assembly may be installed at or in a flow path between the low pressure space and the high pressure space. The valve assembly may be configured to automatically open and close the flow path between the low pressure space and the high pressure space by being automatically operated according to a pressure difference between the low pressure space and the high pressure space.

However, conventional scroll compressors may have the following problems.

First, the valve assembly for preventing high-vacuumization of the low pressure space may include a plurality of components, and the components may have to be individually assembled to one another during an assembly process(es). This may cause the scroll compressor to have a complicated fabrication process(es).

Second, because the valve assembly is disposed between the low pressure space and the high pressure space, a large pressure difference may occur therebetween. This may cause refrigerant of the high pressure space to be leaked to the low pressure space even while the scroll compressor performs a normal driving mode, resulting in lowering of a performance of the scroll compressor.

Hereinafter, a scroll compressor according to embodiments will be explained in more detail with reference to the attached drawings.

FIG. **1** is a longitudinal section view of a low pressure type scroll compressor according to an embodiment. As shown, the low pressure type scroll compressor according to the embodiment of FIG. **1** (hereinafter, referred to as a 'scroll compressor') may include a hermetic container **1** having an inner space divided into a suction space **11**, which is a low pressure space, and a discharge space **12**, which is a high pressure space, a drive motor **2** installed at or in the suction space **11** of the hermetic container **1** that generates a rotational force, a main frame **3** fixedly-installed between the suction space **11** and the discharge space **12** of the hermetic container **1**, a fixed scroll **4** fixedly-installed on an upper surface of the main frame **3**, and an orbiting scroll **5** installed between the main frame **3** and the fixed scroll **4**. The orbiting scroll **5** may be eccentrically coupled to a crank shaft **23** of the drive motor **2**, and may form a pair of compression chambers (P) which consecutively move together with the fixed scroll **4**.

The inner space of the hermetic container **1** may be divided into the suction space **11** and the discharge space **12** by the fixed scroll **4**. A suction pipe **13** may he coupled to the suction space **11** so as to communicate therewith, and a discharge pipe **14** may be coupled to the discharge space **12** so as to communicate therewith.

Although not shown, the inner space of the hermetic container may be divided into a suction and low pressure space, and a discharge and high pressure space by a discharge plenum having a hermetic discharge space and fixedly coupled to the fixed scroll. Alternatively, the inner space of the hermetic container may be divided into a suction space and a discharge space by a high and low pressure separation plate (not shown) fixed to an upper surface of the fixed scroll and closely contacting an inner circumferential surface of the hermetic container.

The fixed scroll **4** may be provided with a fixed wrap **42** that protrudes from a bottom surface of a plate portion **41**, and having an involute shape so as to form a compression chamber (P) together with an orbiting wrap **52** of the orbiting scroll **5**. A suction opening **43** may be formed on a bottom surface of an outer circumferential surface of the plate portion **41** of the fixed scroll, so that the suction space **11** of the hermetic container **1** may communicate with the compression chamber (P). A discharge opening **44** may be formed at a center of the plate portion **41** of the fixed scroll **4** so that the discharge space **12** of the hermetic container **1** may communicate with the compression chamber (P). The orbiting scroll **5** may be provided with the orbiting wrap **52** that protrudes from an upper surface of a plate portion **51**, and having an involute shape so as to form a compression chamber (P) together with the fixed wrap **42**.

Reference numeral **6** denotes a sub-frame, **7** denotes a check valve, **21** denotes a stator, and **22** denotes a rotor.

The scroll compressor according to the embodiment of FIG. **1** may he operated as follows. Once the drive motor **2** generates a rotational force by receiving power supplied thereto, the orbiting scroll **5**, which is eccentrically coupled to the crank shaft **23** of the drive motor **2**, forms a pair of compression chambers (P), which consecutively move between the orbiting scroll **5** and the fixed scroll **4** while the orbiting scroll **5** performs an orbiting motion. The compression chambers (P) may have a volume that gradually decreases toward the discharge opening **44** (discharge chamber) from the suction opening **43** (suction chamber) and may be consecutively formed through a plurality of stages. Hereinafter, an outer compression chamber is referred to as a first middle compression chamber (P**1**), and an inner compression chamber is referred to as a second middle compression chamber (P**2**).

Refrigerant supplied from outside of the hermetic container **1** may be introduced into the suction space **11**, a low pressure space of the hermetic container **1**, through the suction pipe **13**. The low pressure refrigerant of the suction space **11** may be introduced to the first middle compression chamber (P**1**) through the suction opening **43** of the fixed scroll **4**, and may be moved to the second middle compression chamber (P**2**) in a compressed state by the orbiting scroll **5**. Then, the refrigerant may be discharged to the discharge space **12** of the hermetic container **1** through the discharge opening **44** of the fixed scroll **4**. These processes may be repeatedly performed.

However, the scroll compressor may have the following problems. When an air conditioner having the scroll compressor is to be moved or when a pump down driving mode for collecting refrigerant in a condenser is to be performed, the scroll compressor may be operated in a state in which a service valve of the suction pipe is closed. The refrigerant filled in the inner space of the hermetic container **1** may be completely discharged to be moved to the condenser. In this case, the inner space of the scroll compressor may become highly-vacuumized during the pump down driving. This may cause severe problems of the scroll compressor, such as damage to the drive motor **2** and a tip seal member that seals the compression chamber.

In order to prevent these problems, as shown in FIG. **1**, a vacuum prevention device **100** that prevents high-vacuumization may be installed at the inner space of the scroll compressor. When the pressure of the compression chamber (P) becomes lower than a predetermined level or when the scroll compressor is stopped, the vacuumization prevention device **100** may allow a portion of the refrigerant discharged to the discharge space **12** to backflow to the suction space **11**, and thus, be re-introduced into the compression chamber (P) by providing communication between the discharge space **12** (high pressure space) and the suction space **11** (low pressure space). The vacuumization prevention device **100** may be installed inside the fixed scroll **4**; however, in this case, defects may occur while the fixed scroll **4** is manufactured or processed. Alternatively, the vacuumization prevention device **100** may be installed outside of the fixed scroll **4**.

FIG. **2** is a longitudinal section view showing a state in which a vacuumization prevention device is installed at an outer side of a fixed scroll according to an embodiment. FIG. **3** is a disassembled perspective view of the vacuumization prevention device of FIG. **2**. FIG. **4** is a longitudinal section view showing an assembled state of the vacuumization prevention device of FIG. **3**. FIG. **5** is a bottom planar view of the vacuumization prevention device of FIG. **2**.

Referring to FIGS. **2** to **5**, the vacuumization prevention device **100** may include a housing **110** coupled to an upper surface of the fixed scroll **4**, a sliding valve **120** slidably inserted in the housing **110** in an axial direction and configured to selectively open and close a flow path between the discharge space **12** and the suction space **11** of the hermetic container **1**, and a valve spring **130** configured to support the sliding valve **120** in an axial direction. When the respective components of the vacuumization prevention device **100**, that is, the housing **110**, the sliding valve **120**, and the valve spring **130** are assembled with other components, the scroll compressor may have a complicated assembly process(es). Accordingly, the vacuumization prevention device **100** may be fabricated as a complete module in an additional process, and then simply assembled at a compressor assembly spot. This may lower the fabrication costs of the scroll compressor.

The housing **110** may include of a housing body **111**, and a housing cover **112** coupled to the housing body **111**. A valve

hole **113** may be formed at or in the housing body **111**, and the valve hole **113** may be covered by a housing cover **112**. The valve hole **113** may have a predetermined length and may be formed at a center of the housing body **111**. Further, the valve hole **113** may be cylindrical in shape and may have a partially-blocked lower end and a completely open upper end.

A fixing portion **114** configured to fix the housing body **111** to the fixed scroll **4** may protrude from a center of a bottom surface of the housing body **111**. A suction pressure hole **115** configured to provide communication between the valve hole **113** and a first bypass passage **45** which will be later explained, may be penetratingly formed at or in the fixing portion **114** in a lengthwise direction.

The first bypass passage **45** may be formed at or in the plate portion **41** of the fixed scroll **4** so as to provide communication between the discharge space **12** of the hermetic container **1** and the suction space **11**. A valve mounting recess **46** having a sectional area larger than that of the first bypass passage **45** may be formed at an end of the first bypass passage **45**. A female screw thread configured to couple with a male screw thread provided at or in the fixing portion **114** of the housing body **111** may be formed on an inner circumferential surface of the valve mounting recess **46**. However, the fixing portion **114** may be inserted into the valve mounting recess **46** by, for example, pressing or welding. In this case, a sealing member (not shown), such as an O-ring, may be installed between the fixing portion **114** and the valve mounting recess **46**.

The housing body **111** may not include the fixing portion **114** shown in FIG. **6**, but rather, may be provided with a male screw thread on an outer circumferential surface thereof. In this case, the male screw thread may be coupled to a female screw thread provided on an inner circumferential surface of the valve mounting recess **46**. A second bypass passage **47** may be formed to be in the valve mounting recess **46**. In this case, the fixing portion **114** may have an outer diameter larger than that when the fixing portion **114** is formed to have the protrusion shape. This may allow the housing to be stably fixed, and the scroll compressor to have an enhanced performance due to a large sealing area.

Although not shown, a fixing portion (not shown) may be formed on an outer circumferential surface of the housing body **111** in the form of a flange, and may be coupled to the housing body **111** by, for example, bolts.

A middle pressure hole **116** may be penetratingly formed at one side of the valve hole **113** of the housing body **111** in a lengthwise direction from a lower end to an upper end of the housing body **111**. A sealing recess **117** may be formed at a lower end of the middle pressure hole **116**, so that refrigerant of a middle pressure (Pb) introduced through the second bypass passage **47** provided at or in the plate portion **41** of the fixed scroll **4** may encompass the periphery of the fixing portion **114**, more specifically, the suction pressure hole.

As shown in FIG. **5**, the sealing recess **117** may have a ring shape so as to always communicate with the second bypass passage when the vacuumization prevention device **100** is assembled. To prevent communication between the two compression chambers, the second bypass passage **47** may have a size not larger than a gap between itself and the fixed wrap **42**, that is, a size smaller than the gap. Although not shown, the sealing recess **117** may be formed in a ring shape so as to communicate with the middle pressure hole **116** on an upper surface of the fixed scroll **4**, that is, a periphery of the second bypass passage **116**.

A discharge pressure hole **118** may be penetratingly formed at an intermediate portion or height of the housing body **111** and extending in a radial direction from an outer circumferential surface of the housing body **111** to an inner circumferential surface of the valve hole **113**. Further, a stepped surface **111***a* for mounting the housing cover **112** may be formed on an upper end of the housing body **111**, and a cover supporting portion **111***b* configured to receive and support the housing cover **112** may be formed on an outer circumferential surface of the stepped surface **111***a* in, for example, a ring shape. The cover supporting portion **111***b* may have a length long enough to receive the housing cover **112** forcibly inserted therein, and then may be bent to support the housing cover **112** in a pressing manner, as shown in FIG. **6**.

The housing cover **112** may be formed, for example, in a disc shape so as to be forcibly inserted into the cover supporting portion **111***b* of the housing body **111**. A communication recess **112***a* configured to provide communication between the middle pressure hole **47** of the housing body **111** and the valve hole **113** may be formed on a bottom surface of the housing cover **112** in, for example, a ring shape.

A sealing member **119**, such as an O-ring, may be inserted between the housing body **111** and the housing cover **112**. Further, as shown in FIG. **7**, an outer circumferential surface of the housing cover **112** may be screw-coupled to the cover supporting portion **111***b* of the housing body **111**.

The sliding valve **120** may have a size large enough for an outer circumferential surface thereof to slidably contact an inner circumferential surface of the valve hole **113**. Further, the sliding value **120** may be formed of a material having a light weight and lubrication characteristics, such as metal or engineered plastic. A fixing protrusion **121** may be formed on a bottom surface of the sliding valve **120** so as to forcibly receive an upper end of the valve spring **130**.

The valve spring **130** may be a compression coil spring having both ends fixed to a lower end of the housing body **111** and the bottom surface of the sliding valve **120**, respectively. The valve spring **130** may have sufficient elasticity to allow an upward motion of the sliding valve **120** (that is, an operation to open the discharge pressure hole as the sliding valve is rapidly moved up when the compression chamber becomes high-vacuumized).

Operation of the vacuumization prevention device of the scroll compressor according to embodiments will be explained hereinafter.

FIG. **8** is a longitudinal section view showing an operation of the vacuumization prevention device when a scroll compressor is operated in a normal driving mode. FIG. **9** is a longitudinal section view showing an operation of the vacuumization prevention device when the scroll compressor is operated in a high-vacuum driving mode.

As shown in FIG. **8**, when the scroll compressor is normally operated, refrigerant inside the compression chamber (P) may be introduced into an upper end of the valve hole **113** through the second bypass passage **47**, the middle pressure hole **116**, and the communication recess **112***a*. Then, the refrigerant may apply pressure to an upper surface of the sliding valve **120**. The sliding valve **120** may overcome the elasticity of the valve spring **130**, and downwardly move to block the discharge pressure hole **118**.

The refrigerant at a middle pressure (Pb) may be introduced into the sealing recess **117** of the housing body **111** through the second bypass passage **47**, thereby passing to the suction pressure hole **115**. As a result, a damping space having the middle pressure (Pb) with respect to a discharge pressure (Pd) and a suction pressure (Ps) may be formed between the discharge space **12** and the suction pressure hole **11**. This may effectively prevent refrigerant discharged to the discharge space **12** from leaking to the first bypass passage **45** through the vacuumization prevention device **100** when the

scroll compressor is operated in a normal driving mode. Accordingly, lowering of a performance of the scroll compressor may be prevented.

On the other hand, when the scroll compressor is operated in a high-vacuum mode, that is, performs a high-vacuum driving, as shown in FIG. **9**, the compression chamber (P) may have a drastically lowered pressure. As a result, pressure applied to an upper end of the sliding valve **120** may be lowered more than in the normal driving mode. As the sliding valve **120** is upwardly moved by a restoration force of the valve spring **130**, the discharge pressure hole **118** may be opened. The refrigerant having been filled in the discharge space **12** may be discharged to the valve hole **113** through the discharge pressure hole **118**, and then introduced into the suction space **11** through the suction pressure hole **115** and the first bypass passage **45**. As a result, the suction space **11** may be prevented from having a drastically-increased temperature, and thus, damage to the drive motor **2** prevented. The refrigerant sucked into the suction space **11** may be supplied to the compression chamber (P), and then discharged to the discharge space **12**. These processes may be repeatedly performed.

As the suction pressure hole **115** may be formed at a lower end of the housing body **111**, the suction pressure hole **115** and the first bypass passage **45** may have short lengths. Accordingly, when the compression chamber (P) becomes highly-vacuumized, the refrigerant inside the discharge space **12** may backflow to the suction space **11** more rapidly. This may prevent the scroll compressor from being in the high-vacuumized state.

Hereinafter, a vacuumization prevention device of a scroll compressor according to another embodiment will be explained. In the previous embodiment, the housing included the housing body and the housing cover configured to cover an open end of the housing body. However, in this embodiment, the housing may include a first housing and a second housing.

FIG. **10** is a longitudinal section view showing a vacuumization prevention device of a scroll compressor according to another embodiment. Referring to FIG. **10**, a housing **210** may include a first housing **211** and a second housing **212**. The first housing **211** may include a valve hole **213** formed extending in upper and lower directions and configured to slidably receive a sliding valve **220** thereinto, a middle pressure hole **216** formed at one side of the valve hole **213** in a lengthwise direction that communicates with an upper end of the valve hole **213**, and a discharge pressure hole **218** that communicates with an intermediate part of the valve hole **213**. The middle pressure hole **216** may be penetratingly formed in lengthwise and radial directions, and may have an end closed by a member, such as, for example, a bolt closure. Accordingly, the middle pressure hole **216** may be implemented as a single hole.

The second housing **212** may be coupled to a lower end of the first housing **211**, for example, by pressing or welding, or by using bolts, so as to cover a lower end of the valve hole **213**. A sealing member (not shown), such as an O-ring, may be inserted between the first housing **211** and the second housing **212** for an enhanced sealing effect. A sealing recess **217**, which may have a ring shape, may be formed at a lower end of the middle pressure hole **216** so as to communicate with the second bypass passage **47** of the fixed scroll **4**.

A fixing portion **214** may be formed at the second housing **212** so as to be inserted into the valve mounting recess **46** of the fixed scroll **4**. This fixing portion **214** may protrude from a center of a lower surface of the second housing **212** by a predetermined height, or may be implemented by a lower part of the second housing **212**, as shown in FIG. **6**. In a case that a female screw thread is formed on an inner circumferential surface of the valve mounting recess **46**, the fixing portion **214** may be provided with a male screw thread screw-coupled to the female screw thread.

Like in the aforementioned embodiment, a suction pressure hole **215** may be formed at a center of the fixing portion **214**. Other configurations and effects may be similar to those of the aforementioned embodiment, and thus, detailed explanations have been omitted.

In this embodiment, the housing **210** may include the first housing **211** and the second housing **212**. This may effectively seal an upper end of the valve hole **213**, thereby enhancing reliability of the vacuumization prevention device.

A vacuumization prevention device of a scroll compressor according to another embodiment will be explained hereinafter. In the previous embodiment, the housing is formed by combining a plurality of components with each other. However, in this embodiment, the housing may include one component. FIG. **11** is a longitudinal section view showing a vacuumization prevention device for a scroll compressor according to still another embodiment.

Referring to FIG. **11**, a housing of the vacuumization prevention device according to this embodiment may include a housing body **310**, which may be formed in a cylindrical shape having one open end and another closed end, a sliding valve **320**, and a valve spring **330** provided at the housing body **310**.

The housing body **310** may be provided with a valve hole **313** at a center thereof, and a lower end of the valve hole **313** may be open to implement a suction pressure hole (not shown). The housing body **310** may be insertingly-coupled to a valve mounting recess of the first bypass passage **45**. A fixing portion **314** having a male screw thread so as to be coupled to a female screw thread of the valve mounting recess **46** may be formed at a lower end of the housing body **310**, that is, an outer circumferential surface of the opening. The fixing portion **314** may be coupled to the valve mounting recess by, for example, pressing or welding. A middle pressure hole **316** may be formed at one side of the valve hole **313** in a lengthwise direction, and a sealing recess **317** may be formed at a lower end of the middle pressure hole **316** in, for example, a ring shape so as to communicate with the second bypass passage **47** of the fixed scroll **4**.

A discharge pressure hole **318** configured to communicate a discharge space **12** and a suction space **11** with each other may be formed at an intermediate part of the valve hole **313**. Other configurations and effects of a vacuumization prevention device according to this embodiment may be similar to those of the previous embodiment(s), and thus, their detailed explanations have been omitted. In this embodiment, the housing may be one component, which may reduce fabrication costs. However, as the suction pressure hole of the housing is open, it may be difficult to modularizing the vacuumization prevention device. Accordingly, a temporary closure may be provided at the opening of the vacuumization prevention device, configured to block the opening when moving the vacuumization prevention device, but open the opening when assembling the vacuumization prevention device to the scroll compressor.

In the scroll compressor according to embodiments disclosed herein, the vacuumization prevention device may include one component, thus, it may be modularized. This may simplify the assembly processes of the scroll compressor. Further, a middle pressure may be formed between inside and outside of the vacuumization prevention device. This may prevent lowering of a performance of the scroll compressor

resulting from leakage of refrigerant of the discharge space to the suction space through the vacuumization prevention device.

According to embodiments, the vacuumization prevention device may be applied to a low pressure type scroll compressor in which an inner space of a hermetic container is divided into a suction space and a discharge space. However, the vacuumization prevention device may be also applied to a high pressure type scroll compressor in which the inner space of the hermetic container forms the discharge space. In this case, the first bypass passage may be formed so as to communicate with the suction opening of the fixed scroll.

A scroll compressor according to embodiments may be capable of preventing vacuumization by returning a part of a refrigerant discharged to a high pressure space to a low pressure space when the low pressure space is vacuumized during an operation.

Further, embodiments disclosed herein provide a scroll compressor capable of having simplified assembly processes by modularizing a valve assembly, and thus, may be capable of reducing fabrication costs.

Further, embodiments disclosed herein provide a scroll compressor capable of having an enhanced performance by reducing leakage of refrigerant to a low pressure space from a high pressure space in a normal driving mode, by reducing a pressure difference at a periphery of the valve assembly.

According to embodiments disclosed herein, a scroll compressor is provided that may include a hermetic container having an inner space divided into a low pressure space and a high pressure space; a compression unit or device installed at the inner space of the hermetic container, and forming a compression chamber which consecutively moves as spiral wraps provided at a plurality of scrolls perform a relative motion by being interlocked with one another; and a valve assembly installed between the low pressure space and the high pressure space of the hermetic container, and configured to selectively communicate the low pressure space and the high pressure space with each other. A sealing recess may be formed at a contact surface between the compression unit and the valve assembly, and the sealing recess may be formed so as to communicate with an intermediate part of the compression chamber.

Further, according to embodiments disclosed herein, a scroll compressor that may include a hermetic container having an inner space divided into a low pressure space and a high pressure space; a compression unit or device installed at the inner space of the hermetic container, and forming a compression chamber which consecutively moves as spiral wraps provided at a plurality of scrolls perform a relative motion by being interlocked with one another; and a valve assembly installed between the low pressure space and the high pressure space of the hermetic container, and configured to selectively communicate the low pressure space and the high pressure space with each other. The valve assembly may include a housing installed between the low pressure space and the high pressure space, having a valve hole to communicate the high pressure space and the low pressure space with each other, having a suction pressure hole to communicate the valve hole and the low pressure space, and having a discharge pressure hole to communicate the valve hole and the high pressure space; a valve slidably inserted into the valve hole of the housing, and configured to selectively open and close a flow path between the low pressure space and the high pressure space; and an elastic member disposed at the valve hole of the housing, and configured to elastically support the valve. A fixing portion configured to fix the valve assembly to the compression unit may be formed at the housing.

Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. A scroll compressor, comprising:

a hermetic container having an inner space divided into a low pressure space at a suction pressure and a high pressure space at a discharge pressure;

a compression device installed at or in the inner space of the hermetic container, and forming a compression chamber that consecutively moves as a plurality of spiral wraps provided at a plurality of scrolls perform a relative motion by being interlocked with one another; and

a valve assembly installed between the low pressure space and the high pressure space of the hermetic container, and configured to provide selective communication between the low pressure space and the high pressure space, wherein a sealing recess is formed at a contact surface between the compression device and the valve assembly, wherein the sealing recess communicates with an intermediate portion of the compression chamber to form an intermediate pressure between the suction pressure and the discharge pressure, wherein a first bypass passage configured to provide selective communication between the low pressure space and the high pressure space via the valve assembly is formed at or in the compression device, and wherein a portion of the first bypass passage is spaced apart from and surrounded by the sealing recess.

2. The scroll compressor of claim **1**, wherein the sealing recess is formed in a ring shape so as to surround the outlet of the first bypass passage.

3. The scroll compressor of claim **2**, wherein a second bypass passage configured to open and close the valve assembly according to a pressure of the compression chamber is formed at or in the compression device, wherein the sealing recess communicates with the second bypass passage.

4. conditioner comprising the scroll compressor of claim **1**.

5. The scroll compressor of claim **1**, wherein the valve assembly comprises:

a housing installed between the low pressure space and the high pressure space, the housing having a valve hole that provides communication between the high pressure space and the low pressure space, a suction pressure hole that provides communication between the valve hole and the low pressure space, and a discharge pressure

hole that provides communication between the valve hole and the high pressure space;

a valve slidably disposed within the valve hole, and configured to selectively open and close a flow path between the low pressure space and the high pressure space; and

an elastic member disposed at or in the valve hole, and configured to elastically support the valve, wherein a fixing portion configured to fix the valve assembly to the compression device is formed at or in the housing.

6. The scroll compressor of claim **5**, wherein the fixing portion is coupled to the outlet of the first bypass passage, and wherein a suction pressure hole is formed at or in the fixing portion so as to communicate with the first bypass passage.

7. The scroll compressor of claim **6**, wherein a second bypass passage configured to provide communication between an intermediate portion of the compression chamber and the high pressure space is formed at or in the compression device, wherein a middle pressure hole configured to provide communication between the second bypass passage and the valve hole is formed at or in the housing, wherein an end of the middle pressure hole is disposed at an opposite side to an end of the suction pressure hole with the valve interposed therebetween, and wherein the discharge pressure hole is formed between the middle pressure hole and the suction pressure hole.

8. The scroll compressor of claim **7**, wherein the sealing recess is formed between the second bypass passage and the middle pressure hole.

9. The scroll compressor of claim **7**, wherein a diameter of the second bypass passage is equal to or smaller than a gap between the plurality of wraps.

10. The scroll compressor of claim **7**, wherein the housing comprises:

a housing body having the valve hole, the middle pressure hole, the suction pressure hole, and the discharge pressure hole; and

a housing cover configured to cover the valve hole.

11. The scroll compressor of claim **10**, wherein the housing body and the housing cover are coupled to each other by at least one of pressing, welding, or a bolt.

12. The scroll compressor of claim **10**, wherein the housing body is provided with a cover supporting portion configured to support the housing cover, an end thereof being bent.

13. The scroll compressor of claim **10**, wherein a sealing member is interposed between the housing body and the housing cover.

14. The scroll compressor of claim **10**, wherein a sealing member is interposed between the housing body and the fixed scroll.

15. The scroll compressor of claim **10**, wherein the middle pressure hole is penetratingly formed at or in the housing body in a lengthwise direction, and wherein a communication recess configured to provide communication between the middle pressure hole and the valve hole is formed at or in the housing cover.

16. The scroll compressor of claim **7**, wherein the housing comprises:

a first housing having the valve hole, the middle pressure hole, and the discharge pressure hole; and

a second housing configured to cover the valve hole of the first housing, and having the suction pressure hole disposed therein.

17. The scroll compressor of claim **16**, wherein the first housing and the second housing are coupled to each other by at least one of pressing, welding, or a bolt.

18. The scroll compressor of claim **16**, wherein a sealing member is interposed between the first housing and the second housing.

19. The scroll compressor of claim **7**, wherein the housing comprises a housing body having the valve hole, the middle pressure hole, and the discharge pressure hole, and wherein one end of the valve hole which cons lutes an opening of the housing body is open to be connected to the first bypass passage, and is fixed to the compression device.

20. The scroll compressor of claim **5**, wherein the valve assembly is provided with a fixing portion formed on one side surface of the housing in a shape of a protrusion having a predetermined height and diameter.

21. The scroll compressor of claim **5**, wherein an outer circumferential surface of the housing of the valve assembly is insertingly fixed to the compression device.

22. An air conditioner comprising the scroll compressor of claim **5**.

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